# Some subtle details of imaging using a negative refractive medium

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We analyzed the time evolution of image formation in 2D and 3D super lenses. The relationship between resolution, absorption, and the time to reach stabilization is quantitatively established with concrete examples. We find significant differences in the time evolution dynamics between 2D and 3D focusing. We find a characteristic image oscillation in two dimensional focusing that is induced by a vortex-like surface excitation with a zero group velocity; while in 3D, image oscillation is inevitable if the real part of effective permittivity and permeability is not exactly -1.

All realizations of meta-materials are through structural resonances and the validity of the theory predictions hinges on the fact (or assumption) that the wavelength under consideration is much larger than the structural length scale so that it is meaningful to talk about an effective permittivity and permeability; and that effective medium provides a good description of the physics of the phenomena, such as imaging. We examine quantitatively how far an effective medium can carry us in the particular case of subwavelength imaging. For that purpose, we construct a model in which the resonanting units can be made as small as we please, and we see that even in that limit, there is a difference between the true system (with microstructure) and that represented by its effective permittivity and permeability.